Results of USGS Chemical Analysis and Quality Control for the USEPA Well MW02, Pavillion, WY; Sampled by USEPA on April 22, 2012

INTRODUCTION

The U.S. Environmental Protection Agency (USEPA) installed and sampled two deep monitoring wells (MW01 and MW02) near Pavillion, WY as part of a larger investigation of groundwater contamination in the area. The previous phases of the investigation were completed from 2009-11. A USEPA Draft report titled Investigation of Ground Water Contamination near Pavillion, Wyoming (U.S. Environmental Protection Agency, 2011, http://www.epa.gov/region8/superfund/wy/pavillion/) provides findings from the 2009-11 sample collection and analysis activities at the two EPA-installed deep monitoring wells and other wells. A scientific peer panel was organized by the USEPA to review their Draft report (U.S. Environmental Protection Agency, 2011). This activity is planned to take place in the late fall and early winter of 2012.

In February 2012, a Technical Team comprised of representatives of U.S. Geological Survey (USGS), the State of Wyoming, the Wind River Environmental Quality Commission and the Northern Shoshone Business Council was formed. The latter two agencies are Tribal representatives from the Wind River Indian Reservation. The team's purpose was to reach consensus on groundwater sampling, chemical analysis methods, and quality assurance practices to be used by the USGS for the purpose of reporting on results from MW01 and MW02.

The USEPA returned to the Pavillion area in April 2012 to continue the groundwater investigation, sampling the same two deep monitoring wells, this time, in partnership with the U.S. Geological Survey (USGS), Wyoming Department of Environmental Quality and the Tribal representatives from the Wind River Indian Reservation.

Although the USGS and EPA collected and analyzed samples taken from MW01 on April 24, 2012, the USGS did not collect samples from MW02 on April 22 for reasons detailed elsewhere (Wright and McMahon, in preparation). However, USEPA collected a split set of samples from MW02 on April 22 and sent these samples for chemical analysis to the USEPA laboratories and to the USGS contract laboratory, Test America Laboratory (TAL). The samples sent to TAL were analyzed for selected chemical compounds. The TAL sample results were reviewed and evaluated for laboratory-specific quality control measures by the USGS. This report contains those results.

Purpose and Scope

Purpose

The USGS, a non-regulatory agency, has a long history of providing scientific data and information to help inform local and national policy decisions. The purpose of this report is to provide an independent set of laboratory results analyzed by TAL and quality assured by USGS for split samples collected by the USEPA from deep monitoring well MW02 on April 22, 2012. These results are meant to provide additional information for comparative purposes to the USEPA for their investigation in Pavillion, Wyo. Results may be compared between the laboratories as the list of chemical compounds and analytical chemistry methods used by the laboratories of USGS and USEPA were well coordinated to provide comparable approaches to sample analysis, quality assurance, and quality control. The objective of analyzing split samples collected by USEPA from monitoring well MW02 and analyzed by USEPA and USGS

laboratories is to provide a complete set of quality assured and independently analyzed results with supporting information on the chemical composition of the groundwater from MW02.

Scope

Analytical tests were performed for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), Gasoline Range Organics (GRO), Diesel Range Organics (DRO), glycols, Dissolved and Total Organic Carbon (DOC and TOC), anions, metals and trace elements, and mercury by TestAmerica Laboratory, Inc in Arvada Colorado using USEPA SW-846 methods. EPA SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, is the official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with the RCRA regulations. Additional analyses were performed for dissolved gases, nutrients, and methylene blue active substances (MBAS) using standard USEPA methods.

Quality controls were in place at each step of the process to ensure data reliability starting with Chain-of-Custody (CoC) processing at laboratory receiving and continuing through final customer (USEPA) review. TAL performs standard QA/QC processes including, but not limited to, matrix spikes, matrix spike duplicates, method blanks, laboratory control samples, and laboratory control sample duplicates. Further quality assurance occurred during review of the data package at the USGS National Water Quality Laboratory (NWQL) and through an outside data validation company. Additionally, for this project, the USEPA submitted blind performance evaluation samples to TAL.

Methods of Analysis

This project used the standard sample receipt and tracking form (Appendix 1). Samples were shipped overnight using Federal Express to TAL Denver (4955 Yarrow St., Arvada, CO 80002). Upon receipt the cooler was checked for intact custody seals, correct temperature, and numerous other criteria (see data packet page 6295 to 6298). A summary description of the analyses requested, the location of the analyzing TestAmerica laboratory and the methods used for analysis can be found in Table 1.

Table 1

METHOD SUMMARY

Description	Location	Method	Preparation Method
Volatile Organic Compounds (GC/MS)	DEN	SW846 8260B	SW846 5030B
Semivolatile Organic Compounds (GC/MS)	DEN	SW846 8270C	SW846 3520C
Semivolatile Organic Compounds (GC/MS SIM)	DEN	SW846 8270C SIM	SW846 3510C
Gasoline Range Organics (GC)	DEN	SW846 8015B	SW846 5030B

Dissolved Gases (GC)	DEN	RSK	RSK-175
Diesel Range Organics (GC)	DEN	SW846 8015B	SW846 3510C
Metals (ICP) Dissolved	DEN	SW846 6010B	SW846 3005A
Metals (ICP) total	DEN	SW846 6010B	SW846 3010A
Metals (ICP/MS) Dissolved	DEN	SW846 6020	SW846 3005A
Metals (ICP/MS) Total	DEN	SW846 6020	SW846 3020A
Mercury (CVAA) Dissolved and Total	DEN	SW846 7470A	SW846 7470A
Nitrogen, Ammonia	DEN	MCAWW 350.1	
Nitrogen, Nitrate-Nitrite	DEN	MCAWW 353.2	
Phosphorus, Total (Low Level)	DEN	EPA 365.1	MCAWW 365.2/365.3/365
Phosphorus, Total (Low Level)	DEN	EPA 365.1	MCAWW 365.2/365.3/365
Anions, Ion Chromatography	DEN	SW846 9056	
Organic Carbon, Dissolved (DOC)	DEN	SW846 9060	
Organic Carbon, Total (TOC)	DEN	SW846 9060	
Solids, Total Dissolved (TDS)	DEN	SM 2540C	
Glycols	AUS[1]	SW846 8015	
Dissolved Gases (GC)	PIT[2]	RSK-175	
Methylene Blue Active Substances (MBAS)	SAV[3]	EPA 425.1	

[1] The 8015B Glycols + Methanol analysis presented in this report was performed at TestAmerica Austin, 14050 Summit Drive,Suite A100, Austin, TX 78728, 512.244.0855.

[2] The requested RSK_175 (Propane) analysis presented in this report was performed at TestAmerica Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, 412.963.7058.

[3] The requested 425.1 MBAS Surfactants analysis presented in this report was performed at TestAmerica Savannah, 5102 LaRoche Avenue, Savannah, GA 31404, 912-354-7858

Upon delivery of sample results to the NWQL the data packets were reviewed for contract compliance. Items checked included hold-time compliance, matrix spike results, laboratory control sample results, and duplicate reproducibility. The checklist used for this review is included as Appendix 2.

A summary of the quality controls in place can be found in table 2. It should be noted that all of these steps are routine with the exception of the Data Validation and Performance Evaluation samples. These quality processes were added to provide increased confidence in the final data.

Table 2

QA/QC Type	Purpose	Checking
Chain-of-Custody	Ensure sample integrity	Sample integrity
Sample receiving checklist	Verify sample condition	Sample condition
Matrix Spikes	Determine Matrix Affects	Recovery and RPD
Laboratory Control Samples	Confirm Instrument Operation	Recovery and RPD
Blanks	Contamination check	Contamination

Surrogates	Check Preparation Efficiency	Recovery
Duplicates	Check Reproducibility	Consistency
Contract Review	Ensure Contract Compliance	All of the above plus hold-time, correct files and overall meets contract requirements
Data Validation	Provide outside review	Entire data package
Performance Evaluation Samples	Check Laboratory Performance through blind check samples	Laboratory performance for the analytes of interest
Final Customer Review	Logic Check	Are results reasonable for the sampling location and conditions

An example CoC form is provided as Appendix 1. Scans of the completed CoC forms are provided in the Data Packet PDF appendices (see Read Me First file for page numbers).

Even though contract review is the responsibility of the NWQL and data validation was provided through an outside contract with the NWQL it should be noted that the contract review involves significant scrutiny of the data quality (see Appendix 2).

The contract for data validation services requires the validating reviewer to "Review and validate the reported analytical results collectively for the data package as a whole, including laboratory qualifiers … Summarize data and quality control (QC) deficiencies and evaluate the impact on overall data quality" and "Assign appropriate data validation qualifiers as necessary and prepare analytical data validation report."

The Performance Evaluation samples were reviewed by USEPA personnel.

Results

Sample results are provided in 5 files. A summary of these files is provided in table 3.

Table 3

File Name	File Type	Contents
280-28076-1 - Glycols & Methanol - QUA08	CSV	Glycol analytical results
280-28076-1_Qua08	CSV	Analytical results other than glycols
J28076-1 Std_Tal_L4_Package_Mini Final Report (1 of 3)	PDF	Laboratory report with supporting documentation
J28076-1 Std_Tal_L4_Package_Mini Final Report (2 of 3)	PDF	Laboratory report with supporting documentation
J28076-1 Std_Tal_L4_Package_Mini Final Report (3 of 3)	PDF	Laboratory report with supporting documentation

The sample was collected, shipped, and analyzed using Chain-of-Custody protocols. CoC records and sample preservation were checked upon sample arrival at the laboratory as documented in Attachment 1.

Based on the results of the performance evaluation samples and the laboratory certifications provided on pages 383 to 385 of the laboratory report (J28076-1 Std_Tal_L4_Package_Mini Final Report (1 of 3)) there are no laboratory level qualifications to these results. Sample result level qualifiers are included in the files listed in Table 3 above and have been summarized in Appendix 3.

The data quality review at the NWQL is to determine if laboratory contract requirements have been met and to provide an overview of potential problems with the determination and quality of the analytical results. The completed worksheet documenting the results of this data review is included as Appendix 4.

With over 400 individual sample results there were only 14 detects on the laboratory blanks and only 1 of those, pyrene, had a result above one-half of the method reporting level (RL). Even the pyrene blank result was less than the RL. The laboratory control sample results were all in and the number of matrix spike results flagged (31) was well within expectations for the sample matrix and number of analyses.

Overall, the quality control results for the blanks, laboratory control samples, matrix spikes, and duplicates indicate that this data set is of good quality and can be used with confidence when the associated qualifiers are included.

Independent data validation performed by AQA Associates and confirmed these findings as demonstrated by the attached report (Attachment 2). Additionally, the Performance Evaluation samples were reviewed by USEPA personnel and correspondence on July 11, 2012 indicated that "All results were within acceptance limits" indicating the acceptability of the analytical laboratory.

Since the results are of acceptable quality they are included as Attachments 3 through 7. File names and descriptions may be found in Table 3 above.

For easier navigation of the associated files see Appendix 5. That file contains page numbers for key areas of the data package, information on file contents, and definitions for commonly used abbreviations and qualifiers.

LITERATURE CITED

- USGS Sampling and Analysis Plan
- EPA Draft Report on Pavillion groundwater quality dated December 8, 2011.
- EPA Methods of Analysis (?) possibly incorporate by reference to TAL report or live links to EPA Web sites with methods.

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Abreviations : USEPA = US Environmental Protection Agency

MCAWW = "Methods For Chemical Analysis Of Water And Wastes" EPA-600/4-79-020, March 1983 And Subsequent Revisions
RSK = Sample Prep And Calculations For Dissolved Gas Analysis In Water Samples Using A GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab
SM = "Standard Methods For The Examination Of Water And Wastewater"
SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And its Updates.

Appendix 1

Denver
4955 Yarrow Street
Arvada, CO 80002
phone 303.736.0100 fax 303.431.7171

Chain of Custody Record

TestAmerica

TestAmerica Laboratories, Inc.

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Your Company Name here	Tel/Fax:	Lab Contact:	Carrier:	____ of ____ COCs
Address:	Analysis Turnaround Time			Job No.:
City/State/Zip:	Calendar [C] or Work Days (W) ____			
(xxx) xxx-xxxx Phone:	TAT if different from Below ____			SDG No.:
(xxx) xxx-xxxx FAX:	☐ 2 weeks			
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P.O.#	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ____

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant Poison B ☐ Unknown ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

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Appendix 2

CONTRACT LABORATORY DATA-REVIEW WORKSHEET

1.0 GENERAL INFORMATION

Data reviewer: _____ Review date:

Office, Project, & Account #:

2.0 DATA DELIVERABLES

Date of Lab analytical report: _Number of copies: bound _unbound

No. of CD copies of raw-data report: Remarks:

Raw-data report reviewed? Yes ___No _Electronic data files on CD? Yes _No

EDD file format: QWDATA TAL QUA08____ERPIMS_____Other

Date rec'd data deliverables: _Date sent deliverables to USGS office

3.0 INVOICE STATUS FOR LOT: _____

4.0 SAMPLE INFORMATION *(Page #'s listed in this worksheet refer to lab analytical report)*

Sample collection date(s): _____Sample matrix:

No. of sample types in lot: Environmental Trip blank _ Equip. blank
MS/MSD _ Other:

Date samples received at laboratory:

4.1 Were accelerated turn-around times (TATs) requested for analyses? Yes ____No

If yes, list TAT period and if completed:

4.2 Were analyses on chain-of-custody (COC) form performed by lab? YES ____NO

If **no**, list missing or cancelled analyses and reason for non-performance:

4.3 Were the samples properly preserved, labeled, no lab log-in problems, and(or) at appropriate temperature (<6 deg. C) upon receipt by the laboratory: Yes _____No

If **no**, list sample/lab IDs, and associated problems or reference lab report case narrative:

(NOTE: For this review I only included the first page of this form. The full Appendix is 4 pages)

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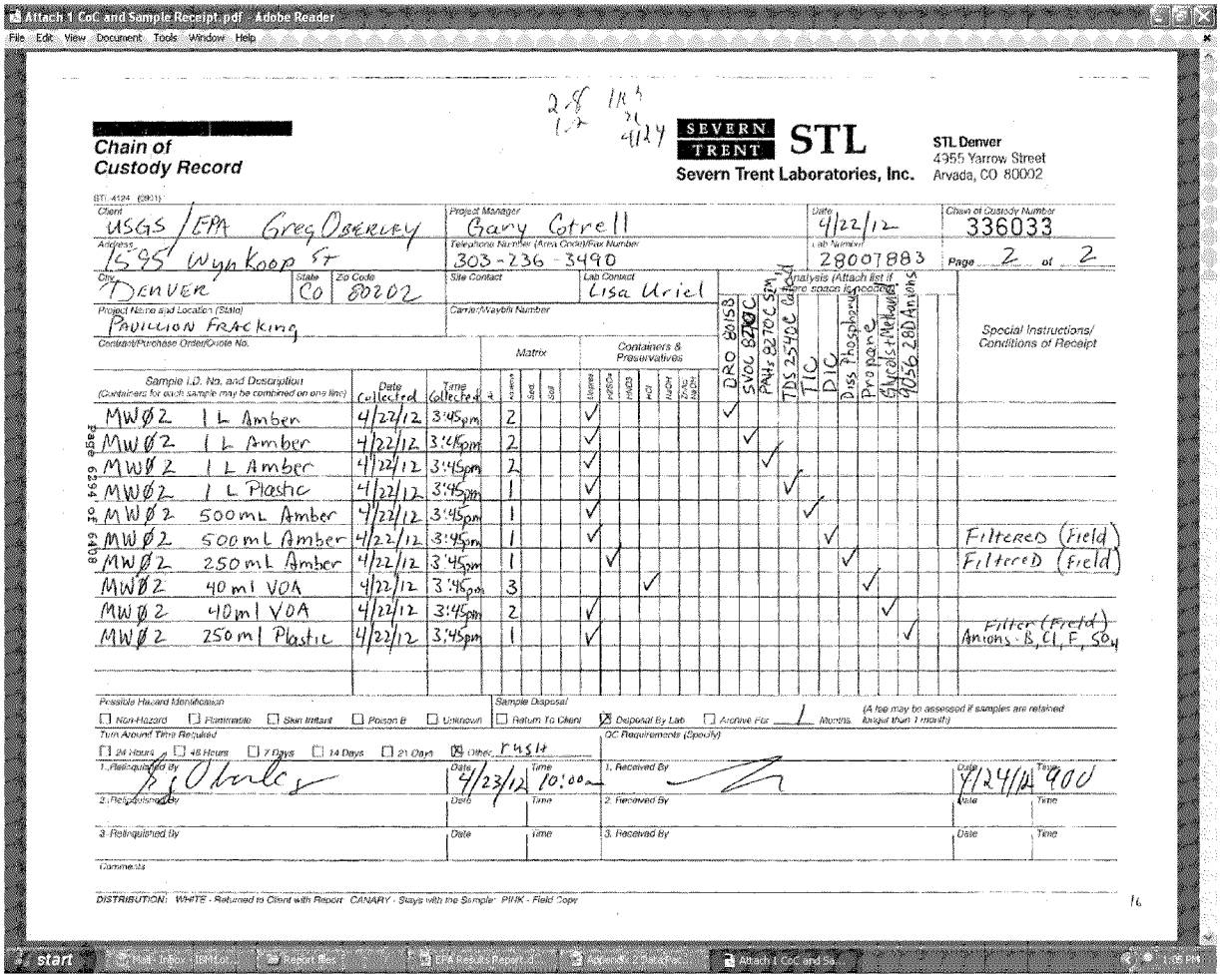
Attachment 1


Attach 1 CoC and Sample Receipt.pdf - Adobe Reader

File Edit View Document Tools Window Help

2 of 2 IR 3 4124

Chain of Custody Record

SEVERN TRENT STL

Severn Trent Laboratories, Inc.

STL Denver
4955 Yarrow Street
Arvada, CO 80002

(STL 4124 (0901))

Client	Project Manager	Date	Chain of Custody Number
USGS / EPA Greg Oberley	Gary Cotrell	4/22/12	336033
Address: 1595 Wynkoop St	Telephone Number (Area Code)/Fax Number: 303-236-3490	Lab Number: 280078B3	Page 2 of 2
City: Denver / State: CO / Zip Code: 80202	Site Contact	Lab Contact: Lisa Uriel	Analysis (Attach list if more space is needed)
Project Name and Location (State): Pavillion Fracking	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			Special Instructions/ Conditions of Receipt

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date Collected	Time Collected	# Containers	Matrix: Water	Sed.	Soil	Containers & Preservatives: HNO3	H2SO4	HCl	NaOH	ZnAc NaOH	DRO 8015B	SVOC 8270C	PAHs 8270C SIM	TDS 2540C	TIC	DIC	Diss. Phosphorus	Propane	Glycols+Methanol	4056 28D Anions	
MW02 1 L Amber	4/22/12	3:45pm	2				✓					✓										
MW02 1 L Amber	4/22/12	3:45pm	2				✓						✓									
MW02 1 L Amber	4/22/12	3:45pm	2				✓							✓								
MW02 1 L Plastic	4/22/12	3:45pm	1				✓								✓							
MW02 500mL Amber	4/22/12	3:45pm	1				✓									✓						
MW02 500mL Amber	4/22/12	3:45pm	1				✓										✓					Filtered (Field)
MW02 250mL Amber	4/22/12	3:45pm	1					✓										✓				Filtered (Field)
MW02 40ml VOA	4/22/12	3:45pm	3						✓										✓			
MW02 40ml VOA	4/22/12	3:45pm	2				✓													✓		
MW02 250ml Plastic	4/22/12	3:45pm	1				✓														✓	Filter (Field) Anions - B, Cl, F, SO4

Page 6294 of 6308

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For 1 Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other Rush

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
[signature]	4/23/12	10:00	[signature]	4/24/12	900
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

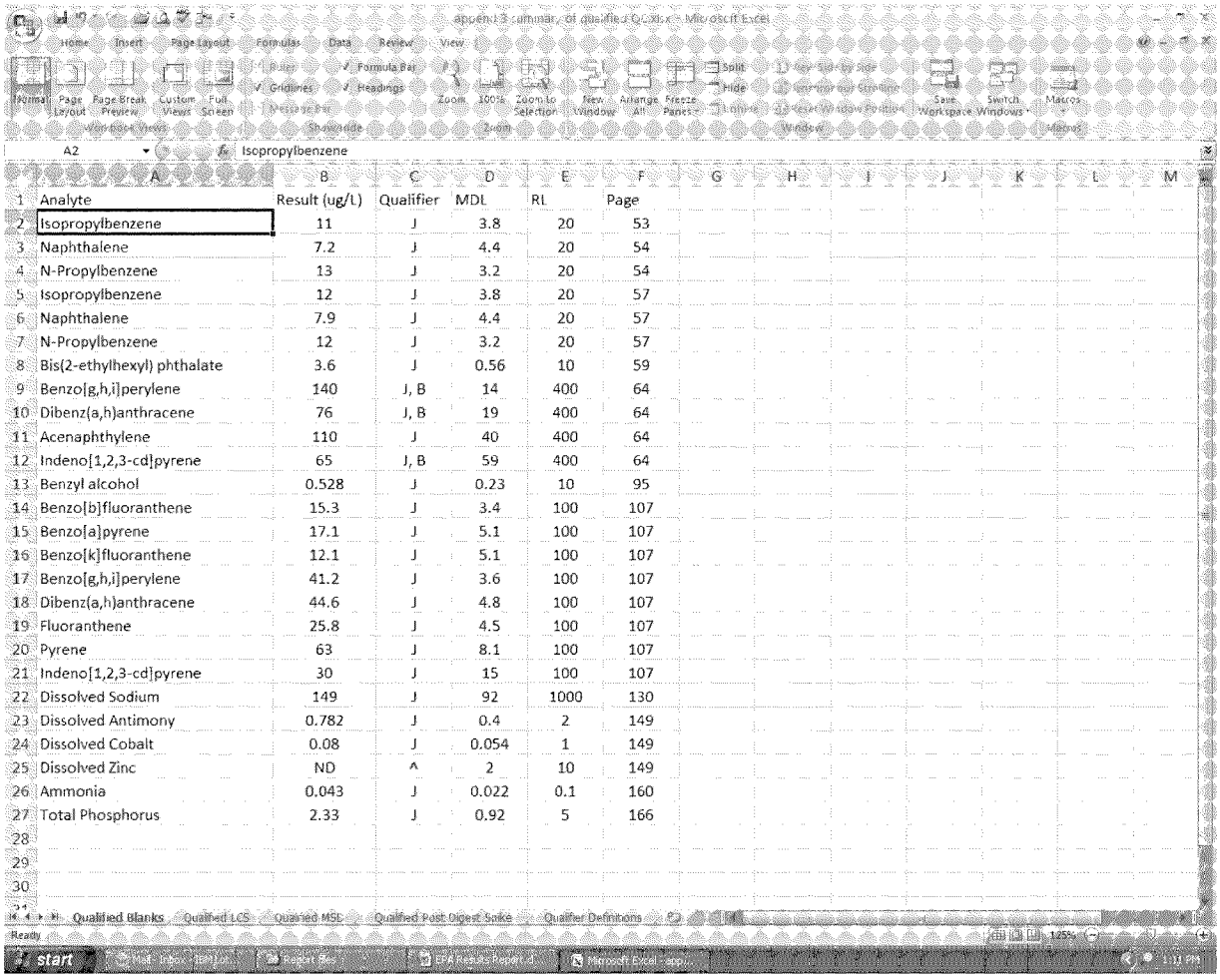
DISTRIBUTION: WHITE - Returned to Client with Report CANARY - Stays with the Sample PINK - Field Copy

16

start | Mail - Inbox - Microso... | Report Files | EPA Results Report 2... | Appendix 2 Backgro... | Attach 1 CoC and Sa... | 1:05 PM

(NOTE: For this review this is a screen shot of the first page of this attachment)

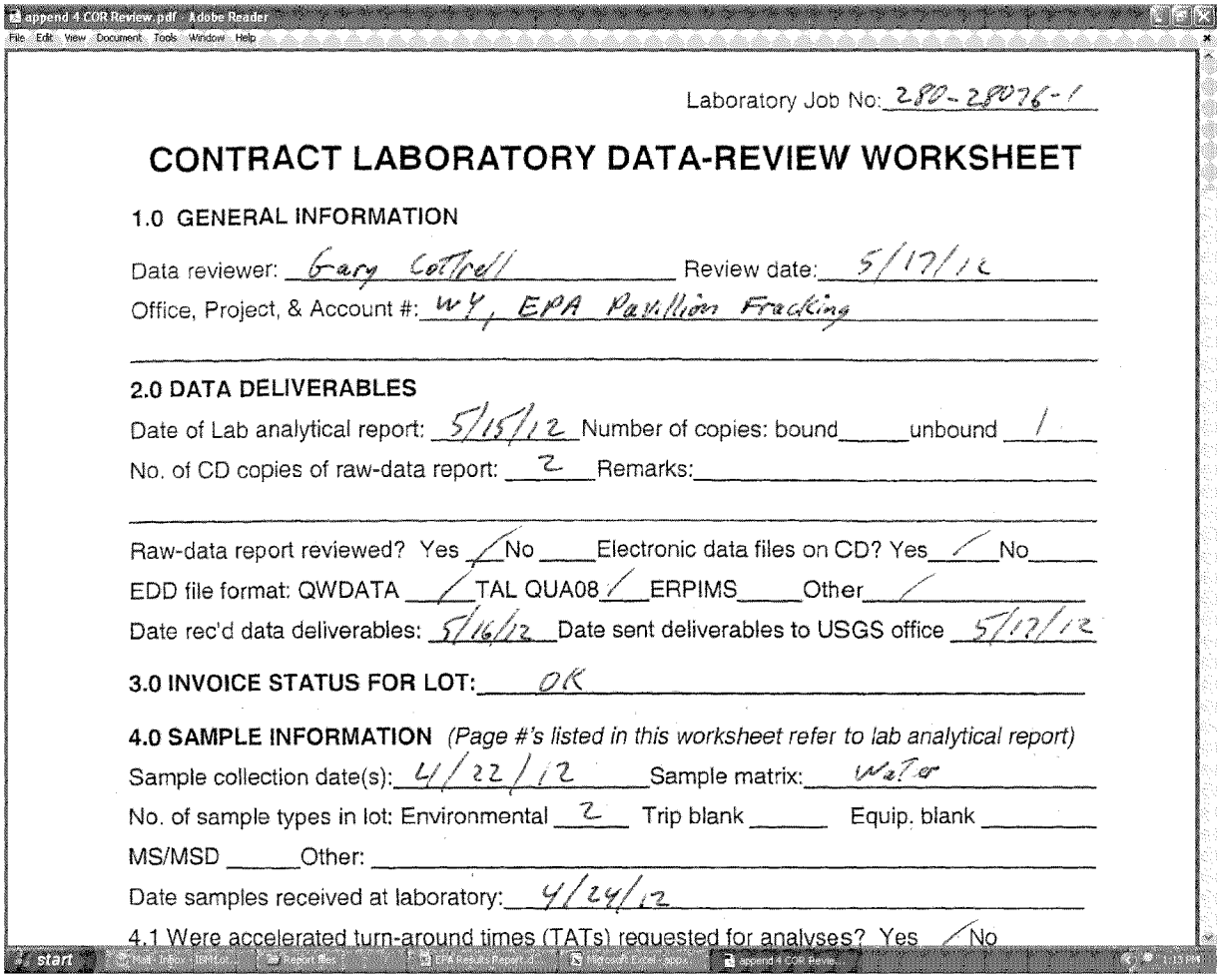
Appendix 3



	A	B	C	D	E	F
1	Analyte	Result (ug/L)	Qualifier	MDL	RL	Page
2	Isopropylbenzene	11	J	3.8	20	53
3	Naphthalene	7.2	J	4.4	20	54
4	N-Propylbenzene	13	J	3.2	20	54
5	Isopropylbenzene	12	J	3.8	20	57
6	Naphthalene	7.9	J	4.4	20	57
7	N-Propylbenzene	12	J	3.2	20	57
8	Bis(2-ethylhexyl) phthalate	3.6	J	0.56	10	59
9	Benzo[g,h,i]perylene	140	J, B	14	400	64
10	Dibenz(a,h)anthracene	76	J, B	19	400	64
11	Acenaphthylene	110	J	40	400	64
12	Indeno[1,2,3-cd]pyrene	65	J, B	59	400	64
13	Benzyl alcohol	0.528	J	0.23	10	95
14	Benzo[b]fluoranthene	15.3	J	3.4	100	107
15	Benzo[a]pyrene	17.1	J	5.1	100	107
16	Benzo[k]fluoranthene	12.1	J	5.1	100	107
17	Benzo[g,h,i]perylene	41.2	J	3.6	100	107
18	Dibenz(a,h)anthracene	44.6	J	4.8	100	107
19	Fluoranthene	25.8	J	4.5	100	107
20	Pyrene	63	J	8.1	100	107
21	Indeno[1,2,3-cd]pyrene	30	J	15	100	107
22	Dissolved Sodium	149	J	92	1000	130
23	Dissolved Antimony	0.782	J	0.4	2	149
24	Dissolved Cobalt	0.08	J	0.054	1	149
25	Dissolved Zinc	ND	^	2	10	149
26	Ammonia	0.043	J	0.022	0.1	160
27	Total Phosphorus	2.33	J	0.92	5	166

(NOTE: Screen shot of file. Note 5 tabs, 4 for QC sample types, and a definitions file)

Appendix 4



append 4 COR Review.pdf - Adobe Reader

File Edit View Document Tools Window Help

Laboratory Job No: 280-28076-1

CONTRACT LABORATORY DATA-REVIEW WORKSHEET

1.0 GENERAL INFORMATION

Data reviewer: Gary Cottrell Review date: 5/17/12

Office, Project, & Account #: WY, EPA Pavillion Fracking

2.0 DATA DELIVERABLES

Date of Lab analytical report: 5/15/12 Number of copies: bound _____ unbound 1

No. of CD copies of raw-data report: 2 Remarks: _____

Raw-data report reviewed? Yes / No ____ Electronic data files on CD? Yes / No ____

EDD file format: QWDATA / TAL QUA08 / ERPIMS ____ Other /

Date rec'd data deliverables: 5/16/12 Date sent deliverables to USGS office 5/17/12

3.0 INVOICE STATUS FOR LOT: OK

4.0 SAMPLE INFORMATION *(Page #'s listed in this worksheet refer to lab analytical report)*

Sample collection date(s): 4/22/12 Sample matrix: Water

No. of sample types in lot: Environmental 2 Trip blank _____ Equip. blank _____

MS/MSD _____ Other: _____

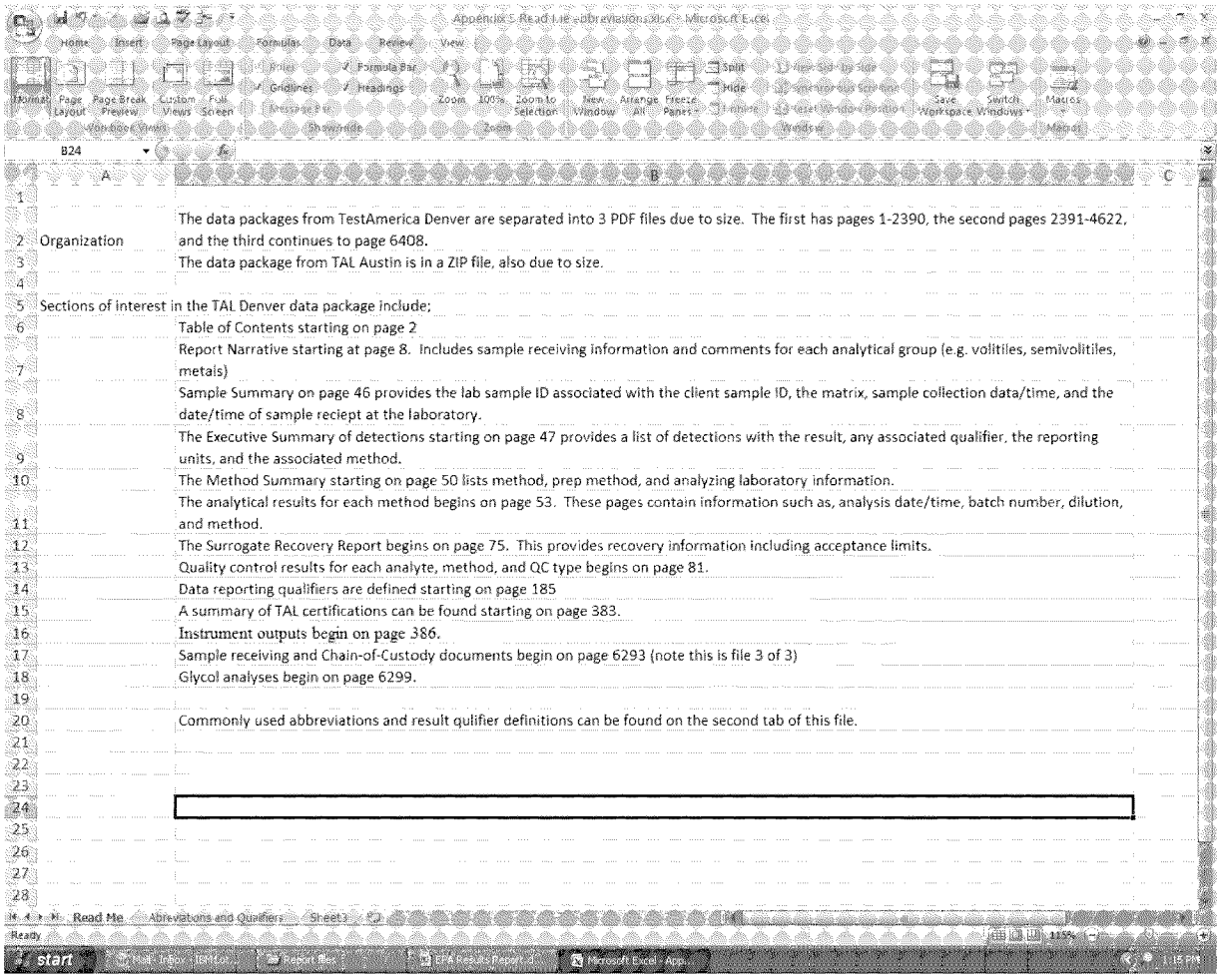
Date samples received at laboratory: 4/24/12

4.1 Were accelerated turn-around times (TATs) requested for analyses? Yes / No

start

(NOTE: Screen shot of first page of this file)

Appendix 5



	A	B	C
1			
2	Organization	The data packages from TestAmerica Denver are separated into 3 PDF files due to size. The first has pages 1-2390, the second pages 2391-4622, and the third continues to page 6408.	
3		The data package from TAL Austin is in a ZIP file, also due to size.	
4			
5	Sections of interest in the TAL Denver data package include;		
6		Table of Contents starting on page 2	
7		Report Narrative starting at page 8. Includes sample receiving information and comments for each analytical group (e.g. volitiles, semivolitiles, metals)	
8		Sample Summary on page 46 provides the lab sample ID associated with the client sample ID, the matrix, sample collection data/time, and the date/time of sample reciept at the laboratory.	
9		The Executive Summary of detections starting on page 47 provides a list of detections with the result, any associated qualifier, the reporting units, and the associated method.	
10		The Method Summary starting on page 50 lists method, prep method, and analyzing laboratory information.	
11		The analytical results for each method begins on page 53. These pages contain information such as, analysis date/time, batch number, dilution, and method.	
12		The Surrogate Recovery Report begins on page 75. This provides recovery information including acceptance limits.	
13		Quality control results for each analyte, method, and QC type begins on page 81.	
14		Data reporting qualifiers are defined starting on page 185	
15		A summary of TAL certifications can be found starting on page 383.	
16		Instrument outputs begin on page 386.	
17		Sample receiving and Chain-of-Custody documents begin on page 6293 (note this is file 3 of 3)	
18		Glycol analyses begin on page 6299.	
19			
20		Commonly used abbreviations and result qulifier definitions can be found on the second tab of this file.	
21			
22			
23			
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28			

(Note: Screen shot of first tab)

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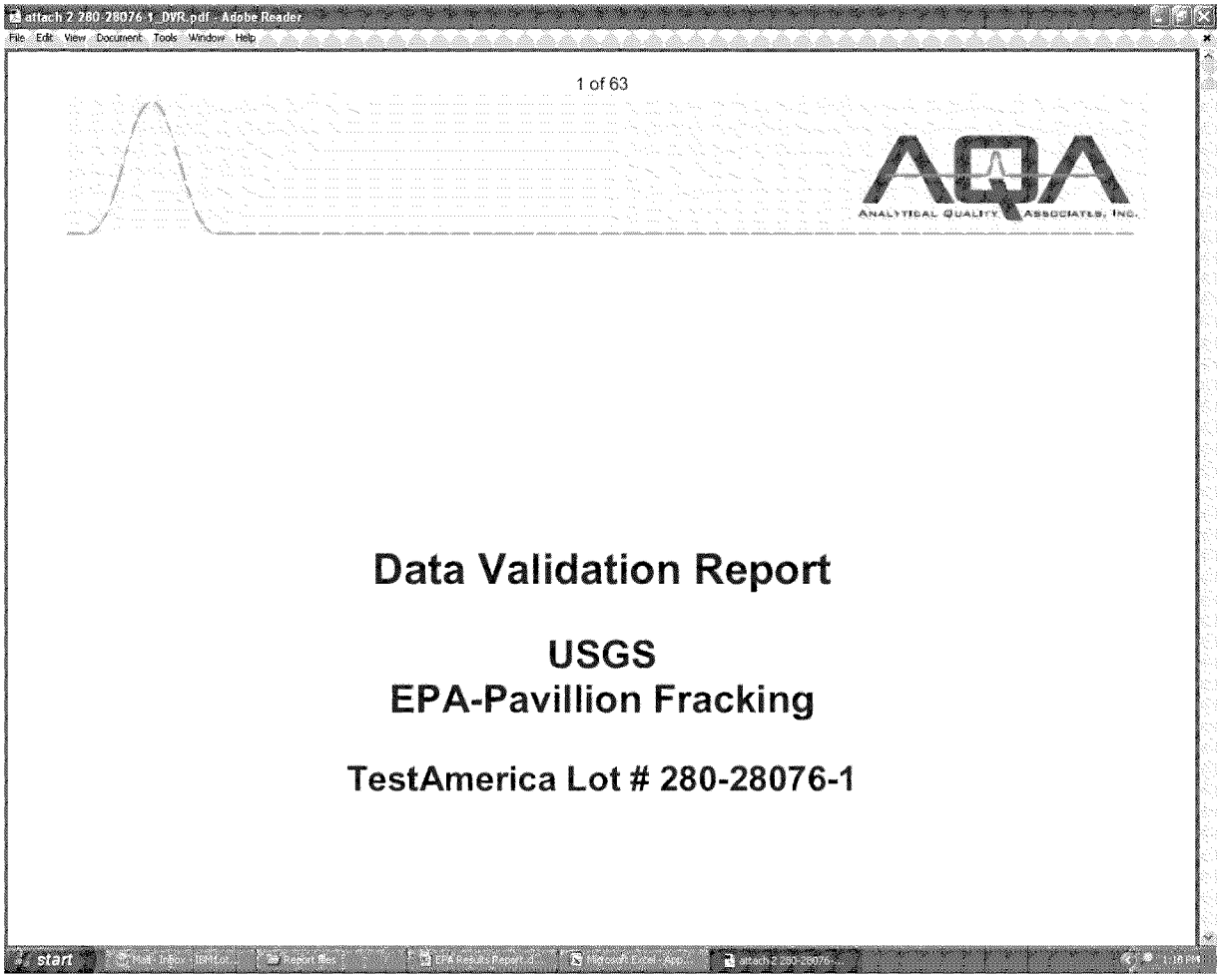
Attachment 2


attach 2 280-28076 1_DVR.pdf - Adobe Reader
File Edit View Document Tools Window Help
1 of 63
ANALYTICAL QUALITY ASSOCIATES, INC.
Data Validation Report
USGS
EPA-Pavillion Fracking
TestAmerica Lot # 280-28076-1
start